Growing the Future: State Efforts to Advance the Life Sciences

BY JOE KENNEDY | FEBRUARY 2018

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Over the last two decades, the medical life-sciences sector, consisting of 12 industries in the pharmaceutical (traditional chemical-based drugs and new biological drugs) and medical devices subsectors, has been a steady generator of increased output, higher employment, and rising wages for the U.S. economy. Because of these positive trends and future growth potential, a growing number of state governments have enacted policies to support new life-sciences start-ups, encourage firms already in the state to expand their investments, and attract new life-sciences activity to their jurisdictions.

The life-sciences sector, particularly the pharmaceutical subsector, is a steady generator of rising output, high-skilled jobs, and high wages. Unlike in many other industries, life-sciences companies have significant flexibility to conduct their research, clinical trials, and production anywhere in the world. Yet they are attracted to and grow in locations that can combine a good business environment with specialized inputs the industry needs, including access to cutting-edge academic research, skilled workers, and a network of suppliers.

This report uses a sample of five states with life-sciences-promotion policies (Colorado, Indiana, New Jersey, North Carolina, and Washington) to examine the important economic role of the life-sciences sector and the proper goals of state policies.

DEFINITION OF THE LIFE-SCIENCES SECTOR

The medical life-sciences sector contains two subsectors, which can be further broken down into 4 groups and 12 separate industries. Using the North American Industry Classification System (NAICS), the life-sciences industry consists of the following:

Pharmaceuticals and Medicines:[1]

32541 Pharmaceutical and Medicine Manufacturing:

- 325411 Medicinal and Botanical Manufacturing
- 325412 Pharmaceutical Preparation Manufacturing
- 325413 In-Vitro Diagnostic Substance Manufacturing
- 325414 Biological Product (except Diagnostic) Manufacturing

54171 Research and Development in the Physical, Engineering, and Life Sciences:

- 541711 Research and Development in Biotechnology
- 541712 Research and Development in the Physical, Engineering and Life Sciences (except Biotechnology)

In 2016, U.S. companies employed 1.2 million workers in the life-sciences sector.

Medical Devices and Equipment:

33451 Electromedical and Electrotherapeutic Apparatus Manufacturing:

- 334510 Electromedical and Electrotherapeutic Apparatus Manufacturing
- 334516 Analytical Laboratory Instrument Manufacturing
- 334517 Irradiation Apparatus Manufacturing

33911 Medical Equipment and Supplies Manufacturing:

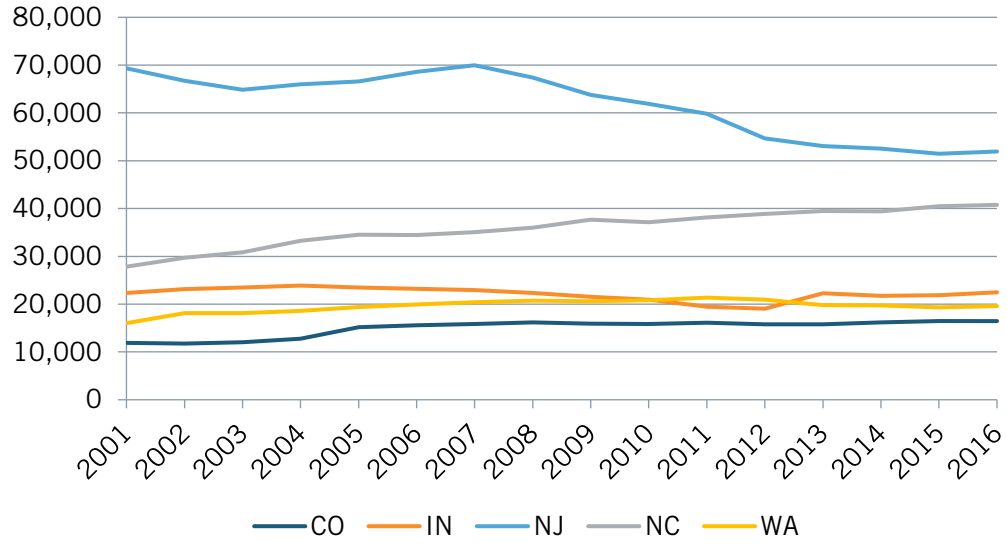
- 339112 Surgical and Medical Instrument Manufacturing
- 339113 Surgical Appliance and Supplies Manufacturing
- 339114 Dental Equipment and Supplies Manufacturing

Employment

In 2016, U.S. companies employed 1.2 million workers in the life-sciences sector, 72 percent of which (906,000) were in the pharmaceuticals subsector. Employment in this subsector (including research) grew 22 percent between 2001 and 2016, with employment in the medical-equipment subsector growing by 10 percent. Both industries grew faster than total nonfarm employment, which only increased by 9.5 percent during this time. Total manufacturing employment actually fell by 27.6 percent during this period.

Figures 1 and 2 show life-sciences employment from 2001 (the earliest year for which data are available) to 2016 in the five states. Employment in North Carolina grew the fastest, at 46 percent, or over 12,900 jobs. Colorado and Washington grew by 39 percent and 22 percent, respectively. Pharmaceutical employment in Indiana grew by less than 1 percent, while New Jersey suffered a 25 percent decline in employment (-17,400 jobs).

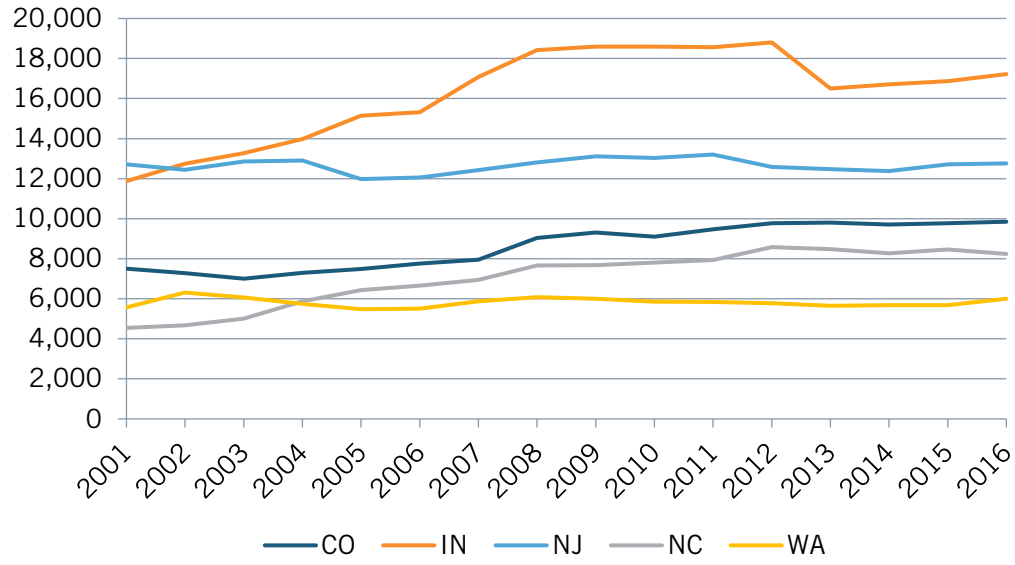
Figure 1: State Employment in Pharmaceuticals and Research[2]



In 43 states, pharmaceutical wages are at least 50 percent greater than each state's average private wage, with premiums topping 75 percent in 24 states.

For medical devices, North Carolina again grew the fastest with a gain of 81 percent, or 3,700 jobs, with Indiana second at 45 percent (5,300 jobs). Colorado grew 31 percent, while Washington gained 8 percent and New Jersey showed no growth.

Figure 2: State Employment in Medical Devices[3]



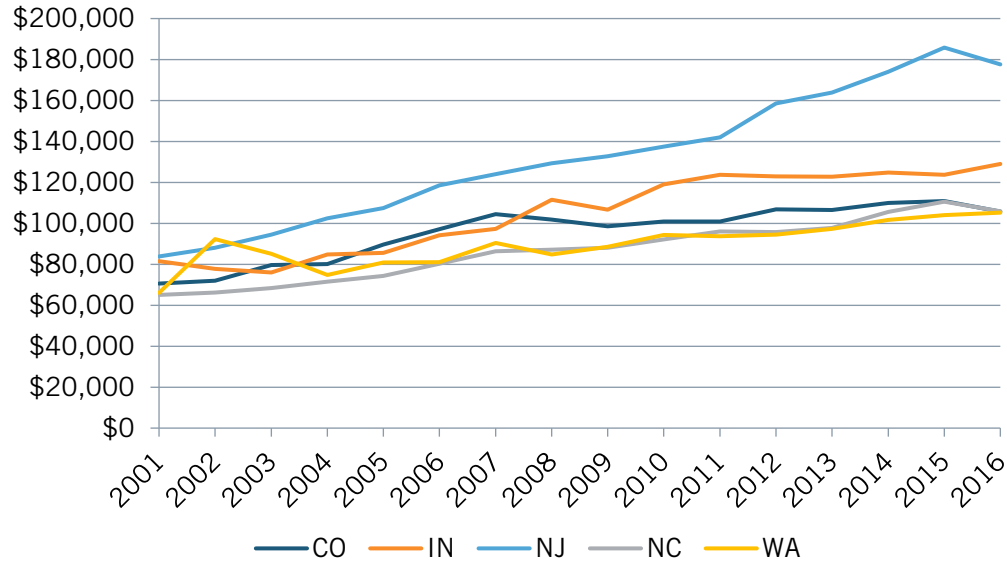
Wages

The life-sciences sector employs a great deal of high-skilled labor. To attract this talent, it pays much higher wages than average. In 43 states, pharmaceutical wages are at least 50 percent greater than each state's average private wage, with premiums topping 75 percent in 24 states.[4] However, within the sector average, wages vary by industry. The highest- and lowest-paying industries in each subsector are separated by a gap of at least $40,000. Also, wages in the pharmaceutical subsector are about $40,000 higher than those in medical

devices. But even those jobs in the lower range are relatively high-paying. The U.S. median annual earnings for full-time wage and salary workers were just under $44,600 in the fourth quarter of 2017.[5] Each of the 12 industries within the life-sciences sector pays well above that.

Figures 3 and 4 show the weighted average wages for pharmaceuticals and medical devices within each of the five states. Also shown is the national average wage for all industries. The wages are influenced by both the average wage in each state for all businesses and the specific mix of life-sciences industries within each state. The average life-science wage in each industry is well above the average for each state, which ranges from $44,600 in Indiana to $62,800 in New Jersey. Yet the lowest average wage for either pharmaceuticals or medical devices in any of these states is $63,100, and most are substantially higher. Just as important, these wages have been growing faster than the national average for all wages over time. Pharmaceutical wages have risen at least 50 percent in each state, thus widening the gap between wages of workers outside the industry. The average annual wage for all jobs rose 48 percent, while the consumer price index increased 36 percent over the same time period.[6] Wages in New Jersey are significantly higher, and have been growing at a much faster rate, than in other states, and may be at least partially responsible for its decline in employment in the sector, as firms choose to grow in lower-wage, yet high-skilled, locations.

Figure 3: Average Annual Wage in Pharmaceuticals and Research[7]



A similar pattern holds for average wages in the medical-device subsector. Wages increased in all five states, from the lowest growth of 34 percent in Indiana to 88 percent in New Jersey. And as with pharmaceuticals, medical-device wages in New Jersey are significantly higher, and growing much faster than elsewhere.

Figure 4: Average Annual Wage in Medical Devices[8]

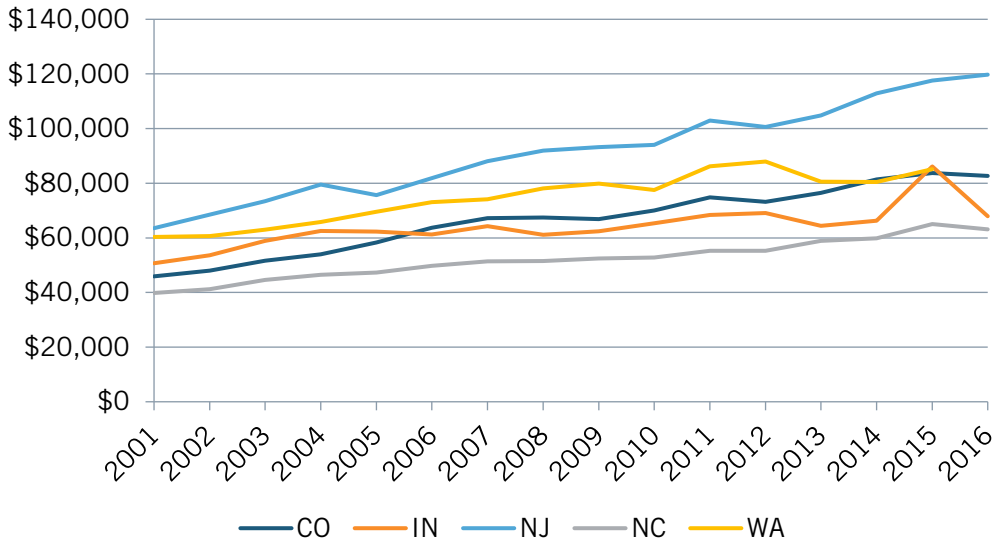


Table 1 shows the premium above each state's average wage that the workers in each of the two subsectors were able to command in 2016.

Table 1: Wage Premium for Life-Science Subsectors[9]

State	Average Pharmaceutical Wage	Average Medical Device Wage	Average Annual Wage	Pharmaceutical Premium	Medical Device Premium
Colorado	$105,804	$82,728	$54,652	$51,152	$28,076
Indiana	$128,995	$67,903	$44,564	$84,431	$23,339
New Jersey	$177,595	$119,738	$62,764	$114,831	$56,974
North Carolina	$105,886	$63,071	$47,268	$58,618	$15,803
Washington	$105,215	$98,704	$59,020	$46,195	$39,684

PATENTS

One indicator of the output generated by investment in life-sciences research and development (R&D) is the number of products that are patented. New Jersey has a clear lead in pharmaceuticals, while Indiana is the leader in medical devices (see figures 5 and 6).[10] All states have seen increases, which reflects a broader national trend (see table 2). Total USPTO awards rose 63.3 percent for pharmaceuticals and medicines, and 161.3 percent for medical equipment, compared with 56.2 percent for patents from all industries.[11]

Figure 5: Number of Pharmaceutical and Medicines USPTO Patents Granted[12]

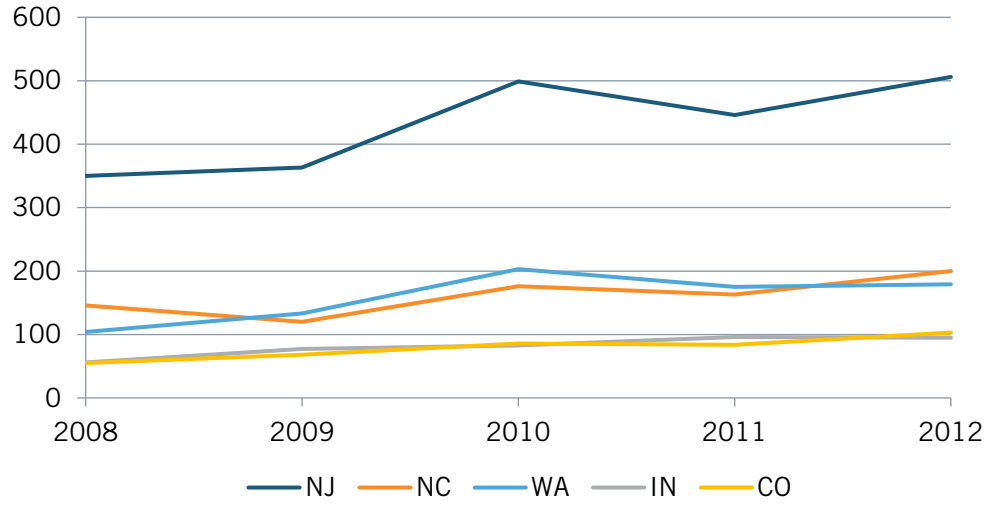


Figure 6: Number of USPTO Patents Granted for Medical Equipment and Supplies[13]

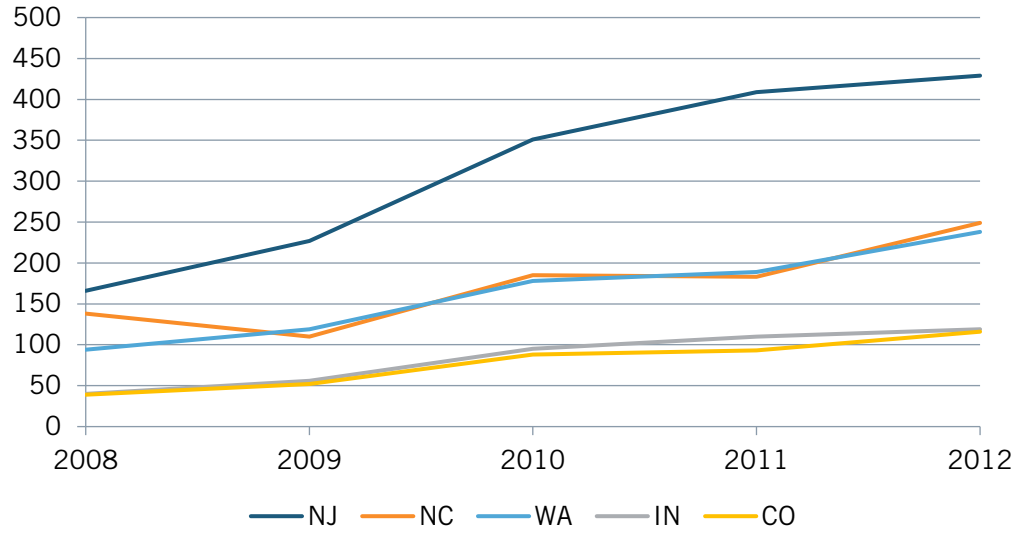


Table 2: Increases in State USPTO Patent Awards[14]

State	Increase in Pharmaceutical Patents	Increase in Medical Device Patents
Colorado	87%	285%
Indiana	70%	292%
New Jersey	45%	153%
North Carolina	37.0%	273.0%
Washington	72.1%	197.4%
United States	63.3%	161.3%

RESEARCH

The life-sciences sector is highly research intensive. Over half of industry research funding in Indiana and New Jersey, and around one-quarter in North Carolina, is in the life sciences (table 3). In part because of the sizable presence of other high-tech industries in Colorado and Washington, the life-science industry's share of total research in these states is smaller (11 and 6 percent respectively). Collectively, the five states account for between 11.2 and 11.5 percent of total U.S. life-sciences research by private companies in three of the four life-sciences industries. However, they account for almost one-quarter of private research in pharmaceuticals.

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Table 3: Domestic Research by Companies by State and Industry, 2013 ($ Million) [15]

State	Pharmaceuticals	Research Services	Medical Equipment	Electromedical	Share of State Research
Colorado	$161	$80	$170	$26	11.3%
Indiana	$2,361	$10	$521	$15	53.0%
New Jersey	$6,369	$125	$299	$66	57.4%
North Carolina	$1,180	$49	$148	$4	24.3%
Washington	$473	$75	$51	$273	6.2%
Share of National Research	23.0%	12.1%	11.2%	15.5%	

START-UPS

Life-science industries account for a significant number of high-tech start-up companies. ITIF recently completed a detailed examination of start-up companies (those 10 years or younger in age) in 10 high-tech areas, including 3 in the life-sciences sector.[16] Life-science industries account for between 25 and 30 percent of all high-tech start-ups in each of the five states (see table 4). The report points out that high-tech firms (including those in the three life-science industries included in the report) are generally better at translating R&D investments into job growth, and high-tech start-ups tend to be even more research-intensive than older firms. In addition, high-tech start-ups also account for a greater share of net job creation than other start-ups.[17]

Table 4: Number of Technology-Based Start-Ups by Industry and State, 2016[18]

State	Pharmaceuticals	Medical Devices	R&D Services	Share of State Start-Ups
Colorado	29	117	1,115	27.1%
Indiana	16	94	631	30.1%
New Jersey	142	262	1,393	30.3%
North Carolina	48	169	1,218	28.3%
Washington	28	200	1,081	25.7%

SPECIALIZATION

Life-science industries account for between 25 and 30 percent of all high-tech start-ups in each of the five states.

States differ considerably in the degree to which their economies are specialized in the life-sciences sector. An industry's concentration within a state can be measured by its location quotient (LQ), which is determined here by dividing the industry's share of a state's employment by its share of national employment. If a state has a location quotient of 2.5 in an industry that makes up 3.0 percent of national employment, it means the industry makes up 7.5 percent of the state's workforce. LQs above 2 signal a high degree of concentration and therefore a likely source of competitive advantage. Table 5 shows the state LQs for both the pharmaceutical and medical-device subsectors.

Table 5: State Location Quotients for 2015[19]

State	Pharmaceutical LQ	Medical Device LQ
Colorado	0.57	1.13
Indiana	1.32	2.83
New Jersey	2.41	1.39
North Carolina	2.64	0.90
Washington	0.52	0.46

Colorado and Washington have a smaller share of pharmaceutical jobs than the national average of 1.0, and Indiana, New Jersey, and North Carolina have a larger share. Compared with the national average of 1.0 for medical-device jobs, Colorado, Indiana, and New Jersey have a higher employment rate, while North Carolina's and Washington's are lower. Altogether, Indiana and New Jersey thus appear to be specialized in both subsectors, with Washington scoring a low LQ in both.

Location quotients, on average, are an indicator of net exports from a particular state to the rest of the world, including other states and nations. When looking only at international

exports, these sectors play an important role (see table 6). In Colorado, medical devices are the state's third-leading export to other countries, accounting for between 6.4 and 7.4 percent of its total exports between 2013 and 2016.[20]

Table 6: Life-Sciences Exports to Other Nations, by State (of the Top 25 Exports for Each State, $ (Millions) [21]

Harmonized Code	Product	2016 Exports	% of Exports	Increase Since 2013
Colorado				
901890	Medical Instruments	$305	4.0%	-2.2%
902110	Orthopedic Devices	$163	2.2%	-34.0%
370110	X-ray Plates	$130	1.7%	83.1%
902750	Optical Instruments	$88	1.2%	-5.0%
902680	Instruments for Liquid Gases	$78	1.0%	77.3%
Indiana				
300490	Medicaments	$3,653	10.5%	-25.7%
300210	Antisera	$1,523	4.4%	67.5%
902131	Artificial Joints	$686	2.0%	-7.5%
901890	Surgical Instruments	$438	1.3%	27.0%
901839	Medical Needles	$425	1.2%	11.5%
300431	Insulin Medicaments	$251	0.7%	-13.1
New Jersey				
300490	Medicaments	$555	1.8%	11.4%
300210	Antisera	$399	1.3%	46.7%
North Carolina				
300210	Antisera	$1,409	4.7%	203.0%
300490	Medicaments	$1,215	4.0%	47.5%
903289	Control Instruments	$268	0.9%	39.6%
900110	Optical Fibers	$240	0.8%	-9.8%
Washington				
901812	Ultrasonic Equipment	$697	0.9%	-4.7%
901890	Surgical Instruments	$221	0.3%	27.0%

Indiana exported $3.7 billion in medicaments to other countries in 2016, which was 10.5 percent of its total exports.[22] Various related life-sciences products accounted for several of Indiana's other top 25 exports. However, exports of medicaments have fallen by almost 26 percent since 2013.

Medicaments were New Jersey's sixth-leading export, with $555 million shipped in 2016. That was 11 percent more than in 2013.[23]

Making up two of North Carolina's top three export products, pharmaceuticals' value rose from $1.3 billion in 2013 to $2.6 billion in 2016, with medicaments increasing 48 percent, and blood and related products gaining 203 percent.[24]

Washington had only one life-sciences product (ultrasonic equipment) among its top 10 exports, trade of which has declined 4.7 percent since 2013. In 2016, the state also exported $221 million in medical instruments, which accounted for only 0.3 percent of its total exports.[25]

More than perhaps any other industry, the life-sciences sector requires a unique ecosystem in order to thrive. The presence of this ecosystem provides a strong competitive advantage to a state.

STATE EFFORTS TO GROW LIFE-SCIENCES INDUSTRY ACTIVITY

More than perhaps any other industry, the life-sciences sector requires a unique ecosystem in order to thrive. The presence of this ecosystem provides a strong competitive advantage to a state. Successful life-science clusters normally have a number of key enablers, including world-class universities focused on technology commercialization; an environment that is attractive for highly skilled life-sciences workers; a robust start-up support system, including venture capital and entrepreneurial support networks; and larger "anchor" life-sciences firms.

To support life-sciences growth and overcome these challenges, many state governments have put in place economic development policies focused on the industry. A 2010 study of state biopharmaceutical industry economic development policies found that: "During the last decade, state governments have increasingly begun to target the biopharmaceutical industry and the larger biosciences because they are economic engines providing high-wage, high-skilled jobs across a range of occupations."[26]

States are engaging in active efforts to attract segments of the life-sciences sector. The National Conference of State Legislatures lists 27 states that have passed legislation to provide some type of funding or assistance to the biotechnology industry.[27] A recent update of state activity identified several common strategies:[28]

- Developing a targeted strategy specifically for pharmaceutical development;
- Creating a leading-edge bioscience research capacity and infrastructure;
- Advancing innovation and entrepreneurial development generally;
- Increasing the availability of capital;
- Building advanced manufacturing capacity;
- Creating specialized business incentives; and
- Building a talent pool of workers, especially those trained in biology.

These focal areas mirror measures being taken by national governments to advance their countries' international leadership.[29] The following examines how five states—Colorado, Indiana, New Jersey, North Carolina, and Washington—are working to create environments that support the growth of their life-sciences sectors.

Colorado

Colorado's life-sciences sector currently supports over 27,000 jobs, a more than 39 percent increase since 2001, with rapidly rising wages that already pay well above the average for other industries (see table 7). There are 1,700 life-sciences firms in Colorado, and the sector continues to expand. Colorado's research institutions launch an average of 20 new bioscience companies each year, supported by venture-capital investments totaling more than $1.6 billion over the last five years.[30]

Colorado has instituted a number of policies to encourage growth in the life sciences. In 2012, the Innovation Center of the Rockies (ICR, which has since merged with Innosphere) entered into a partnership with Colorado State University (CSU) Ventures to improve the commercialization of faculty research.[31] ICR's job is to match its network of business advisors with CSU faculty and graduate students. The partnership concentrates on several fields, including bioscience. In addition, the state legislature passed a bill to strengthen R&D efforts at state colleges by expanding the authority for institutions of higher education to purchase emerging technology for testing and evaluation.[32]

The Colorado Bioscience Association also partnered with the State of Colorado to form the Bioscience Discovery Evaluation Grant Program, which supports research, infrastructure, commercialization, and funding for emerging and early stage companies. The program is now being integrated into the broader Advanced Industries Accelerator Program. From 2007 to 2009, the program made 163 grants totaling just under $10 million. These grants helped form 38 new companies, which obtained $290 million in follow-on capital funding.[33]

The Colorado Institute for Drug, Device, and Diagnostic Development is a nonprofit organization that works to advance the state's bioscience ecosystem by helping to create companies and jobs. The program seeks to identify, fund, and actively manage emerging life-sciences technologies. As of 2015, it has eight companies under its guidance.[34]

Table 7: Colorado Employment, Wages, and Output in the Life-Sciences Sector[35]

	Pharmaceuticals	Medical Devices
Employment 2016	16,458	9,849
Change from 2001	38.7%	31.3%
Total Wages 2016 ($ Thousand)	$1,741,314	$814,792
Change from 2001	107.9%	136.6%
Average Wage 2016	$105,804	$82,728
Change from 2001	49.9%	80.2%
Output 2014 ($ Billion)	$5,569	N/A
Output per worker 2014	$478,889	N/A

Ninety percent of the state's bioscience firms are located along the Front Range, where a biosciences cluster has formed around the Fitzsimons Life Science District (formerly the Fitzsimons Army Medical Center) and the adjacent Anschutz Medical Campus. Still in development, the $5.2 billion project encompasses 578 acres and holds more than six million square feet of space designed to support more than 43,000 bioscience professionals.[36] The development is a collaboration between the State of Colorado, the City of Aurora, and the University of Colorado.[37] As of 2015, Colorado does not have an R&D tax credit.[38]

Indiana

Indiana is home to the headquarters of two relatively large life-sciences companies: Eli Lilly, which was the world's 15th largest pharmaceutical company in 2017, and Zimmer Biomet, a medical-device manufacturer (see table 8 for statistics). The economic impact of the life-sciences industry, including agricultural applications, reached $63 billion in 2015. Although Indiana's strength is abetted by the presence of three major research universities, a recent report argues the state is underperforming in most metrics related to education and research.[39]

Industry will serve as a major source of funding in exchange for a role in defining the Indiana Biosciences Research Institute's research focus in order to optimize commercialization opportunities.

Much of the state's strength is the work of BioCrossroads, a private nonprofit organization established in 2003 to be a catalyst for the life-sciences sector in Indiana. Among other objectives, it seeks to connect firms with corporate, academic, and philanthropic partners; facilitate financial investments; and provide ongoing education about the industry.[40]

BioCrossroads has established two funds to invest in new companies: the Indiana Future Fund and the INext Fund, totaling $73 million and $58 million, respectively. These efforts complement the state's work in providing seed capital generated from state, philanthropic, and industry sources to businesses for the purpose of commercializing and validating their technology.[41]

In 2012, BioCrossroads launched a state-wide public-private partnership, the Indiana Biosciences Research Institute, with an initial $25 million in state money, and an equal sum from corporate and philanthropic donors. Industry will serve as a major source of funding in exchange for a role in defining the Institute's research focus in order to optimize commercialization opportunities. The Institute will initially focus on conducting precompetitive research on interrelated human health issues, including cardiovascular disease, diabetes, obesity, and nutrition.[42] In addition, the University of Indiana recently joined with four other universities, Eli Lilly, and Takeda Pharmaceuticals to form the Strategic Pharma-Academic Research Consortium for Translational Medicine to work on discovery and precompetitive drug research.[43]

Indiana's R&D tax credit is the most generous in the nation, allowing companies to deduct 10–15 percent of R&D expenses.[44]

Table 8: Indiana Employment, Wages, and Output in the Life-Sciences Sector[45]

	Pharmaceuticals	Medical Devices
Employment 2016	22,468	17,216
Change from 2001	0.6%	45.0%
Total Wages 2016 ($ Thousand)	$2,898,265	$1,169,024
Change from 2001	59.3%	94.1%
Average Wage 2016	$128,995	$67,903
Change from 2001	58.3%	33.9%
Output 2014 ($ Billion)	$36,123	N/A
Output per worker 2014	$1,518,909	N/A

New Jersey

New Jersey has by far the largest life sciences industry among the five states reviewed in this report (see table 9). It is also home to two of the world's top 25 medical-device companies and three of the top 25 pharmaceutical companies.[46] Although New Jersey is second only to California in both pharmaceutical employment and output, state and industry officials have frequently expressed concerns about competition from other jurisdictions. In response, those officials have made a concerted effort to attract and keep as much pharmaceutical activity as possible.

The New Jersey Economic Development Authority (EDA) has provided support to firms in the industry.[47] For example, in 2016, it helped fund a start-up called Visikol, which was trying to develop a safer-clearing optical agent for biology labs. EDA provided discounted lab and office space at its Commercialization Center for Innovative Technologies (CCIT). CCIT is located between two major research universities and provides 46,000 square feet and 27 wet labs to nearly two dozen companies. It also provides companies with educational programs and support resources, including networking opportunities, administrative support, and assistance finding funding.

In 1985, New Jersey created the Commission on Science and Technology to encourage the development of biotechnology and other high-tech industries in the state.[48] Unfortunately, however, the Commission was defunded in 2010 due to budget cuts.[49] That same year, the legislature set up an organization currently known as the Center for Advanced Biotechnology and Medicine under the joint governance of Rutgers University, the State University of New Jersey, and the University of Medicine and Dentistry of New Jersey. The center was created to promote grants and research in the state.[50]

New Jersey's R&D tax credit allows companies to deduct 10 percent of qualifying expenses.[51] Further, the New Jersey Emerging Technology and Biotechnology Financial Assistance Program allows qualified businesses to sell unused tax credits to other companies.[52]

Table 9: New Jersey Employment, Wages, and Output in the Life-Sciences Sector[53]

	Pharmaceuticals	Medical Devices
Employment 2016	51,952	12,767
Change from 2001	-25.1%	0.4%
Total Wages 2016 ($ Thousand)	$9,226,419	$1,528,691
Change from 2001	58.8%	89.2%
Average Wage 2016	$177,595	$119,737
Change from 2001	111.9%	88.4%
Output 2014 ($ Billion)	$47,550	N/A
Output per worker 2014	$722,834	N/A

The Biomanufacturing Research Institute and Technology Enterprise at North Carolina Central University has 31,000 square feet of lab space devoted to applied research in biomanufacturing and biotechnology.

North Carolina

Although not headquarters to any of the biggest companies, North Carolina boasts over 600 life-science companies, including Biogen, Merck, and Pfizer. One report lists the state as being third in biopharmaceutical manufacturing and first in biological manufacturing in the United States (see table 10 for statistics).[54]

North Carolina was one of the first states to target the industry, establishing the nonprofit development organization North Carolina Biotechnology Center (NCBiotech) in 1984. Its main purpose is to bring together industry, government, academia, and other key stakeholders to boost the state's biopharmaceutical industry. In addition to offering advice and contacts to life-sciences companies, NCBiotech provides grants and runs a direct-loan program.[55] Since 1989, the program has made loans to 188 companies, 102 of which are still active. These companies employ 2,914 workers and have estimated revenues of $2.8 billion. When indirect and induced effects are taken into account, the companies support 12,666 jobs and generate $4.3 billion in economic activity within the state.[56]

NCBiotech supports both large and small companies, helping them connect with both university researchers and state officials. In addition to providing its own funding, NCBiotech introduces companies to possible funders and facilitates dealings with government offices. Its website links to databases for both service providers and biotechnology jobs, making it easier for small companies to find the resources they need. NCBiotech recently launched RISE North Carolina to ensure its efforts reach every region in the state. Despite its successful track record, the organization has had to fight for resources. Its budget was cut 27 percent in 2013 and almost eliminated two years later.[57]

North Carolina has also undertaken efforts to facilitate advanced manufacturing. The Golden LEAF Biomanufacturing Training and Education Center (BTEC) at North Carolina State has 63,000 square feet of lab space for training students and industry professionals in bioprocessing. It also offers its space and expertise for a range of technical services that utilize unused capacity and generate income that offsets cuts in state funding.

The North Carolina Community College System operates the NCBioNetwork Capstone Center, which provides a simulated environment to instruct students in current good manufacturing practices and other skills critical to biomanufacturing. Finally, the Biomanufacturing Research Institute and Technology Enterprise at North Carolina Central University has 31,000 square feet of lab space devoted to applied research in biomanufacturing and biotechnology.[58]

North Carolina's R&D tax credit is very small, allowing companies to deduct only 1.25 percent of eligible expenses.[59]

Table 10: North Carolina Employment, Wages and Output in the Life-Sciences Sector[60]

	Pharmaceuticals	Medical Devices
Employment 2016	40,768	8,247
Change from 2001	46.4%	81.4%
Total Wages 2016 ($ Thousand)	$4,316,746	$520,143
Change from 2001	138.4%	187.3%
Average Wage 2016	$105,886	$63,071
Change from 2001	62.8%	58.4%
Output 2014 ($ Billion)	$40,867	N/A
Output per worker 2014	$961,669	N/A

Washington

The pharmaceutical sector in Washington consists of 191 pharmaceutical companies, 294 medical-device companies, and 78 nonprofit research institutions (see table 11 for statistics).[61] Much of this activity is centered around the Fred Hutchinson Cancer Research Center in Seattle, which involves over 300 labs and projects. Two recent reports have pointed to a number of challenges in the state's life-sciences environment that have led to a 1 percent decline in life-sciences jobs between 2011 and 2015, as well as drops in patent and research activity. The most pressing problem has been a shortage of qualified talent, exacerbated by a large portion of STEM students leaving the state after graduation.[62]

In order to support the sector, the governor's office has promised to pursue a number of initiatives, including increasing capital investment in the sector, supporting start-up companies, and encouraging an increase in the number of STEM degrees.[63] The state's initial efforts were motivated by a 2004 report on the state's biotechnology industry.[64]

The University of Washington started a $20 million early-stage venture fund with money from foundations, private investors, and the state. The fund will invest in promising start-ups coming out of state research institutions. In addition, the University of Washington's new Commercialization Initiative aims to double within three years the number of new companies created at the university.[65]

For over 10 years, Washington supported the Life Sciences Discovery Fund (LSDF), which provided grants to research and development efforts that were designed to "promote life sciences competitiveness, enhance economic vitality, and improve health and health care."[66] Launched in 2005, LSDF was funded largely from the proceeds of the Master Tobacco Settlement Agreement, and received grants from a number of private foundations. In 2015, Washington's legislature defunded the LSDF, removing $11 million in funds.[67] The legislature also tried to eliminate the LSDF's grant-making authority, but that provision was vetoed by the governor. The LSDF issued a total of 111 grants worth $105 million, which helped attract another $510 million in additional funding and supported more than 40 start-up companies and 3,500 employees.[68] Despite the governor's veto, LSDF's website currently states that, due to funding limitations, it is not offering new grant opportunities.[69] Also in 2015, the legislature allowed the state's R&D tax credit to expire.[70]

In 2016, LSDF gave $1.8 million to the Washington Biotechnology & Biomedical Association (now Life Sciences Washington) to improve commercialization opportunities in the state.[71] The association had previously built an entrepreneur-mentoring program, the Washington Innovation Network for Life Sciences, which had previously assisted 24 companies.

Table 11: Washington Employment, Wages and Output in the Life-Sciences Sector[72]

	Pharmaceuticals	Medical Devices
Employment 2016	19,606	6,002
Change from 2001	22.3%	7.6%
Total Wages 2016 ($ Thousand)	$2,062,836	$592,422
Change from 2001	94.8%	76.1%
Average Wage 2016	$105,215	$98,704
Change from 2001	59.2%	63.6%
Output 2014 ($ Billion)	$5,098	N/A
Output per worker 2014	$336,697	N/A

CONCLUSION

America's pharmaceutical and medical-device subsectors play an outsized role in the nation's economy and that of many states. Although it's not the largest industrial sector, the life sciences are especially important because they provide such a significant number of above-average-wage jobs.

Governments play an important supporting role in helping to determine the environmental factors that influence high-tech sectors such as the life sciences. This is true at both the national and state levels. As ITIF has documented, many nations are seeking to win the global competition for life-sciences jobs by lowering their tax rates, increasing tax incentives for innovation, bolstering patent protections, providing more support to R&D, enhancing

physical facilities, and investing in workforce training.[73] Other countries have used less cooperative means, including tariff barriers, biased drug-approval procedures, forced sharing of technology, and intellectual property theft.

At the same time, 27 U.S. states have specific life-sciences-focused economic development efforts. The states profiled in this report have pursued proactive, and generally effective policies (if not in every single instance) to bolster or grow their life-sciences economies, recognizing that it is not sufficient to leave the sector's fate to markets alone if they wish to be leaders in this increasingly high-value added sector. Also, as this report has shown, for such policies to remain effective, the programs must be comprehensive and have sustained support. States that wish to have robust life-sciences economies and a pro-growth approach to attracting investment and jobs need to put the right constructive supporting policies in place.

ENDNOTES

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10. The subsequent statistics show whole counts. If a patent uses a patent code that applies to more than one industry it is counted once for each industry. This leads to double counting but is the best way to look at trends in specific industries. Patents are assigned to the state of the owner at time of grant, based on the address listed on the application. If the patent is not assigned to an owner and only lists inventors, it is assigned to the address of the first-named inventor.
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